Space Weather Technical Forecast

Issued on Sunday, 01 September 2024 at 12:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-flares expected, slight chance of X-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate with two M-flares in the past 24hrs, peaking with an M1.8 at 31/1302UTC from AR3806 in the southeast. There are eleven sunspot regions on the visible disc. The largest region remains AR3806 in the southeast, which has seen the emergence of a small delta spot within its trailing region. AR3807 in the southwest has matured into a bipolar structure after its rapid growth of recent days, but is starting to show signs of developing mixed polarity spots in the intermediate portion. Some of its intermediate spots have also recently merged into the leader and trailer spots. All other regions are relatively simple and stable at the present time. All other regions are relatively simple and stable at the present time. No Earth directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar winds, as measured by ACE at L1, showed enhancement from CME and/or weak fast wind influence. Wind speeds were generally at slow-ambient levels, briefly becoming slightly elevated, varying between 360-420 km/s, with density near or below average. The Interplanetary Magnetic Field, Bt, was frequently moderate at first, though varying erratically at times, before ending the period weak. Ranging through the period between 5-13nT. The north-south component, Bz, was predominantly negative with some positive intervals, ranging from -11 to +8nT. Phi angle was mostly positive (away from the Sun), though did end the period in a negative (towards the sun) orientation. Geomagnetic activity was Quiet to Active (Kp2-4).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The 24-hour fluence was below the Active threshold, with 2.52e6 integrated pfu observed at 01/0000UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with a slight chance of isolated X-flares. The main flare risk is currently from AR3806 in the southeast.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs currently expected. The ongoing enhancement is due from either a weak high speed stream and/or weak transient. Further minor geomagnetic activity is possible on Day 1 (01 Sep), with the next forecast enhancement expected either late on Day 1, or more likely on Day 2 (02 Sep), from a narrow negative polarity equatorial coronal hole. A significant enhancement is unlikely, however. Mainly Quiet to Active (Kp2-4) activity is expected at first, with a slight chance of G1/Minor Storm intervals (Kp5) on Day 1 (01 Sep) under weak fast wind or transient influence, then again on Day 2 (02 Sep) with further fast wind enhancement possible. The risk then decreasing from Day 3 (03 Sep) onwards, with generally Quiet (Kp1-2) activity expected.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels, with only a very slight chance of reaching the S1/Minor Radiation Storm level. High energy electron flux is expected to remain at background levels, perhaps reaching moderate at times during diurnal maximum. The associated 24-hour fluence is expected to persist below Active.

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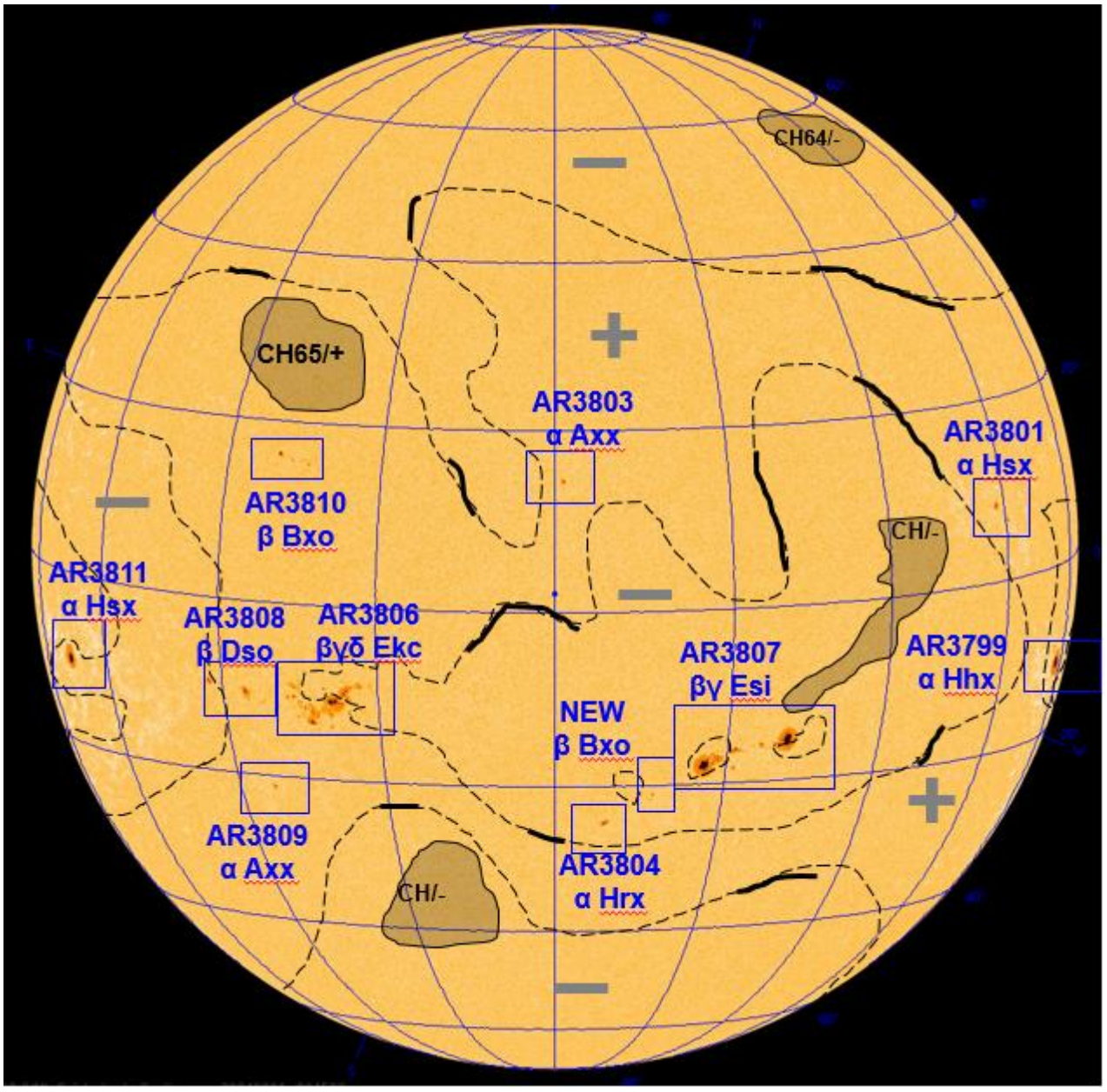
Figure 1. Solar Analysis Valid 01/0700UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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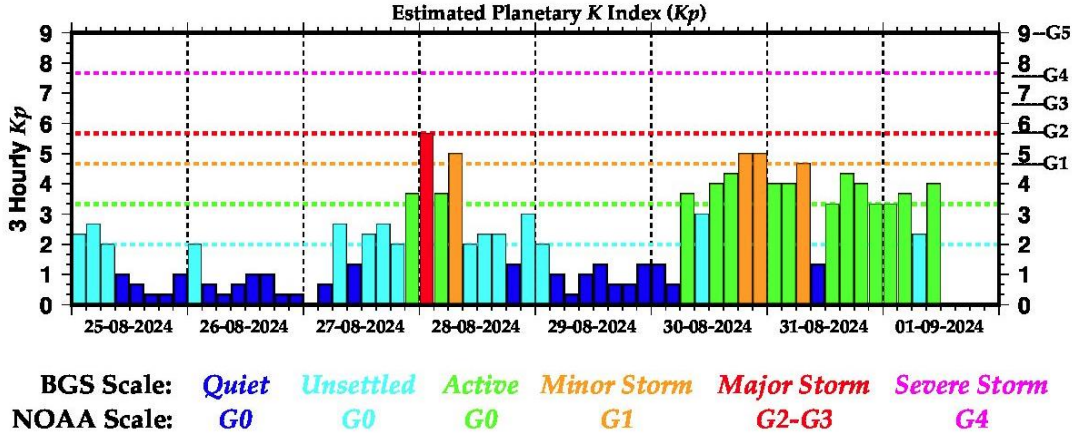
Geomagnetic Storms:

There are no Earth-directed CMEs currently expected. A filament eruption around 30/2330 UTC is expected to miss behind Earth's orbit, but the analysis is low confidence due to poor available imagery, and so a glancing blow cannot be ruled out, perhaps on Day 3 (03 Sep).
The ongoing enhancement is likely due to a weak fast wind and/or a weak transient. Solar winds are at background to slightly elevated speeds currently, with extended periods of southward deflected magnetic field. Should the magnetic field remain southward, further minor geomagnetic activity is possible through early Day 1 (01 Sep).
The next forecast enhancement is expected either late on Day 1 or perhaps more likely on Day 2 (01-02 Sep) from the narrow negative polarity coronal hole straddling the equator in the western hemisphere. Any notable enhancement is low confidence, due to its small size, lack of persistence and unfavoured polarity for the time of year. MOSWOC Enlil is also thought to be overestimating the enhancement on Day 2, suggesting a strong and broad coronal hole fast wind connection that is not expected.
Mainly Quiet to Active (Kp2-4) activity is expected at first, with a slight chance of G1/Minor Storm intervals (Kp5) on Day 1 (01 Sep) under ongoing weak fast wind or transient influence, then again on Day 2 (02 Sep) with further fast wind enhancement possible. The risk then decreasing from Day 3 (03 Sep) onwards in the absence of any CME glance, with generally Quiet (Kp1-2) activity expected.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Estimated Planetary K index (Kp)



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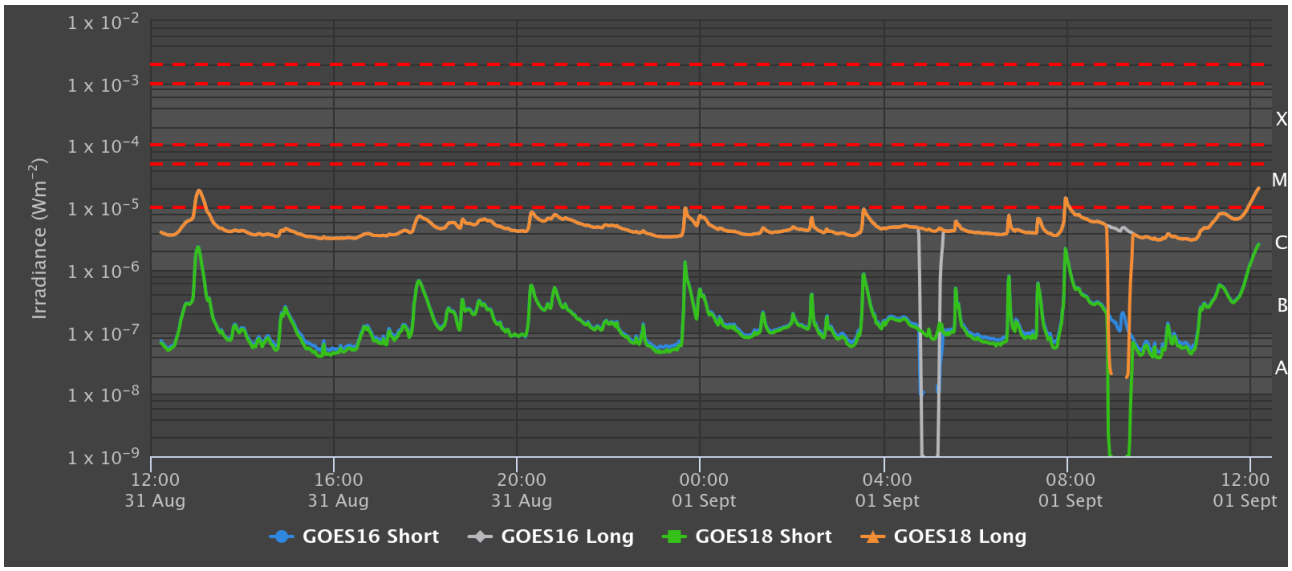
Radio Blackouts - X-Ray Flares:
There are eleven sunspot regions on the visible disc. The largest region remains AR3806 in the southeast, which has seen the emergence of a small delta spot within its trailing region. AR3807 in the southwest has matured into a bipolar structure after its rapid growth of recent days, but is starting to show signs of developing mixed polarity spots in the intermediate portion. Some of its intermediate spots have also recently merged into the leader and trailer spots. All other regions are relatively simple and stable at the present time.
Further Moderate activity is expected, with a slight chance of rising to High. Although there are two regions rotating off the disc in the coming days, there are emerging regions on the east limb and these may well balance any losses - or even raise the probabilities a little. However, we need to wait for a clearer view before this can be properly assessed, and as such a nominal flare risk is maintained.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	75	75
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: GOES18 X-Ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is likely to persist at background levels with a slight chance of rising in response to any notable flares. While there are a few sunspot regions on the western disc, which is the better connected region of the Sun to give the potential for proton flux rises at GEO, these are generally fairly simple magnetically. The risk rises a little beyond Day 3 (03 Sep) as AR3806 crosses into the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background levels. Recent enhancements have given some geomagnetic activity but little in the way of wind speed increases. Whilst there is the potential for increased electron counts at lower orbits, this is considered unlikely to be significant. Periods of moderate flux are possible during diurnal maxima over the coming days.
Despite the potential for any increased flux, the associated 24 hour Fluence is expected to remain below the Active (1e8 integrated pfu) threshold throughout, although a slight rising trend is likely. MOSWOC REFM is providing good guidance for staying below this level, but likely underestimating any potential rising trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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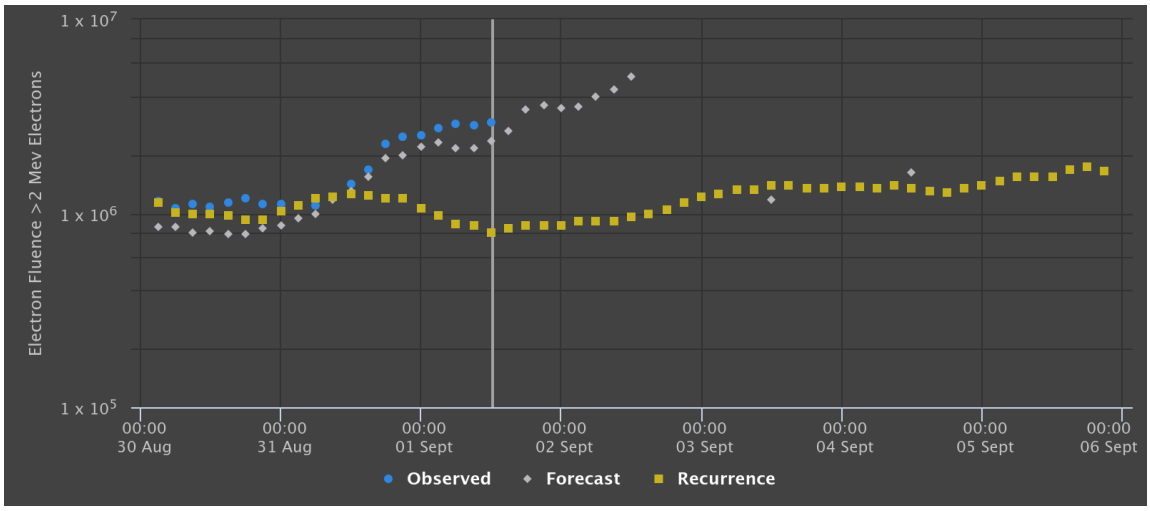
Figure 4: MOSWOC REF Model on a rising trend but well below 1e8 integrated pfu threshold.



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